DRAFT
WORK PLAN FOR DOWNGRADIENT SAMPLING AT EMF SITE/BOEING FIELD PHASE V/SAMPLING

Revision 0

PREPARED FOR
THE BOEING COMPANY
ENERGY AND ENVIRONMENTAL AFFAIRS

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KCSlip4 43871

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TABLE OF CONTENTS

LIST OF FIGURES

KCSlip4 43872

SEA410402

WORK PLAN FOR DOWNGRADIENT SAMPLING AT EMF SITE/BOEING FIELD PHASE V SAMPLING

1.0 INTRODUCTION

Additional sampling is planned for the EMF site in order to characterize the volatile organic compound (VOC) plume located downgradient of the EMF lease property and Boeing Field. The downgradient direction is to the southwest of the EMF site, across Boeing Field and East Marginal Way, within the Plant II property that Boeing owns. The general vicinity of the EMF site, Boeing Field and Plant II is shown in Figure 1.

The objectives of the proposed down gradient sampling are to:

1) Identify the location of the VOC plume (horizontal and vertical extent) in the area of interest.

2) Define the peak concentrations of VOCs within the plume limits.

3) Evaluate geologic conditions and grain size distribution of soil samples from the plume interval

These data are needed to assist evaluating potential remedial actions. One remedy under consideration is monitored natural attenuation (MNA). One key element in demonstrating that MNA is effective is that VOCs from the EMF site are not and will not reach the Duwamish Waterway at concentrations in excess of the site cleanup goals (water quality criteria for protection of aquatic life).

2.0 SUMMARY OF EXISTING MONITORING

The existing site data include VOC analyses from over 100 Geoprobe sampling locations and three years of quarterly groundwater monitoring. The Geoprobe sampling data have been used to develop and refine the understanding of horizontal and vertical distribution of the plume. Based on this understanding of the plume distribution, additional monitoring wells have been added and included in the quarterly monitoring program. The two primary goals of existing sampling and data analysis efforts have been to delineate the plume distribution and to develop quantitative data to characterize the rate of VOC degradation at the site (i.e., to derive first order rate constants of the degradation process based on empirical field data).

An aquifer pumping test has been conducted within the VOC plume on the east side of East Marginal Way (near the fence line with Boeing Field) and numerous soil samples have been collected and submitted for grain size analysis.

A summary of the general plume migration pattern is presented in Figure 2. The existing data collected in the nearest up-gradient plume cross section are presented in Figures 3 and 4 (the data from these cross sections are about 400 ft up gradient from the first planned investigation area). The estimated plume width in this up-gradient area is about 550 feet for levels above the method detection limits and about 350 feet for levels above the site cleanup goals (AWQCs).

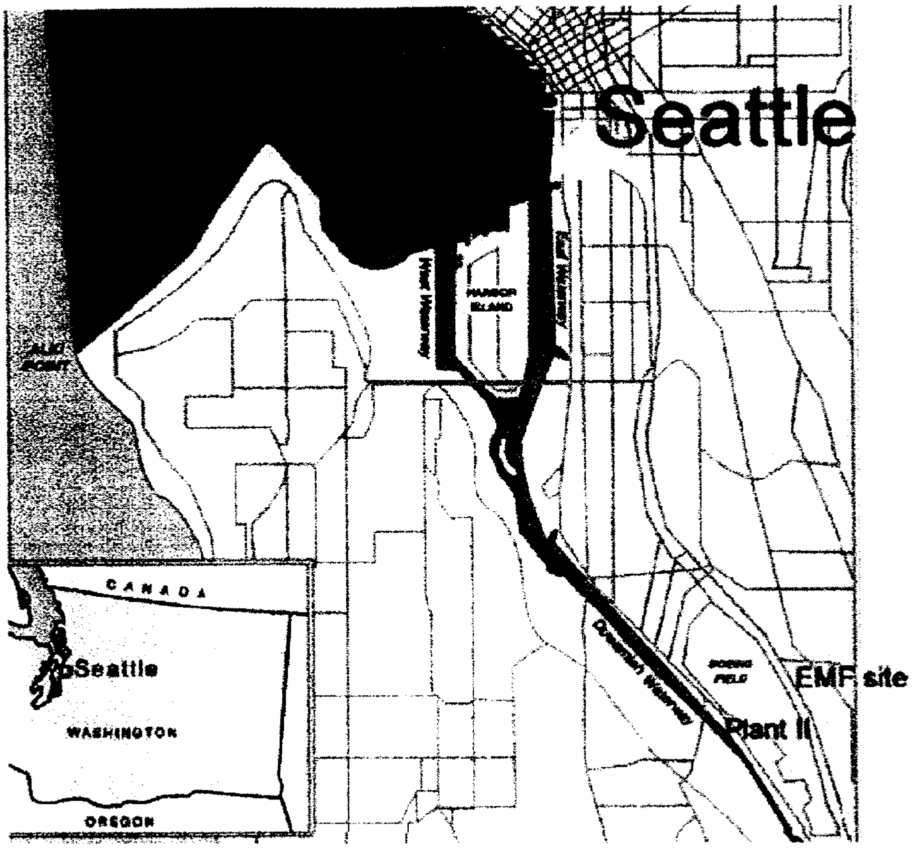

Figure 1. Site Vicinity Map

Figure 2. Estimated Path of VOC Plume from EMF Site

KCSlip4 43875

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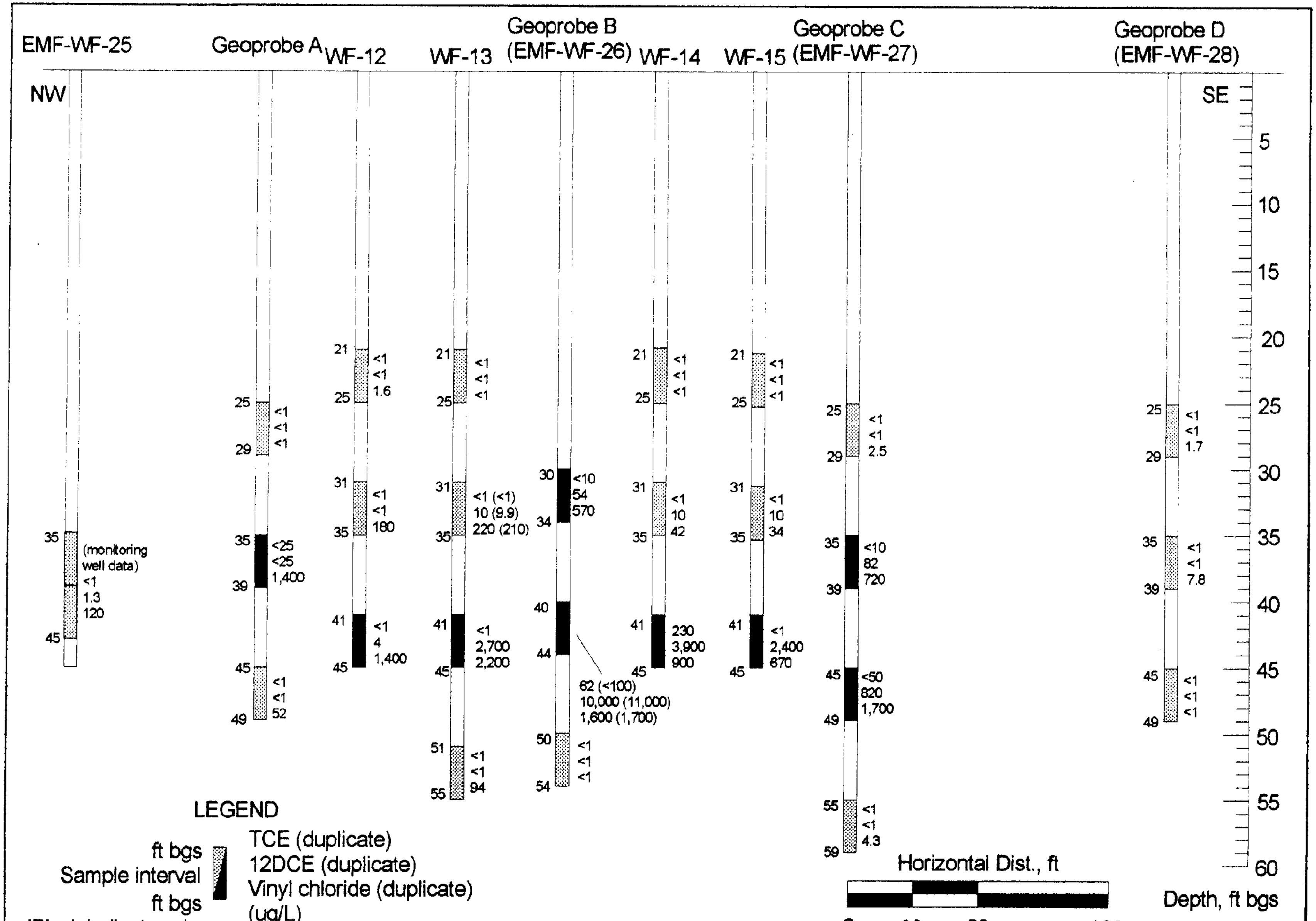

Figure 3 Analytical Results Geoprobe Sampling near Fenceline with East Marginal Way

KCSlip4 43876

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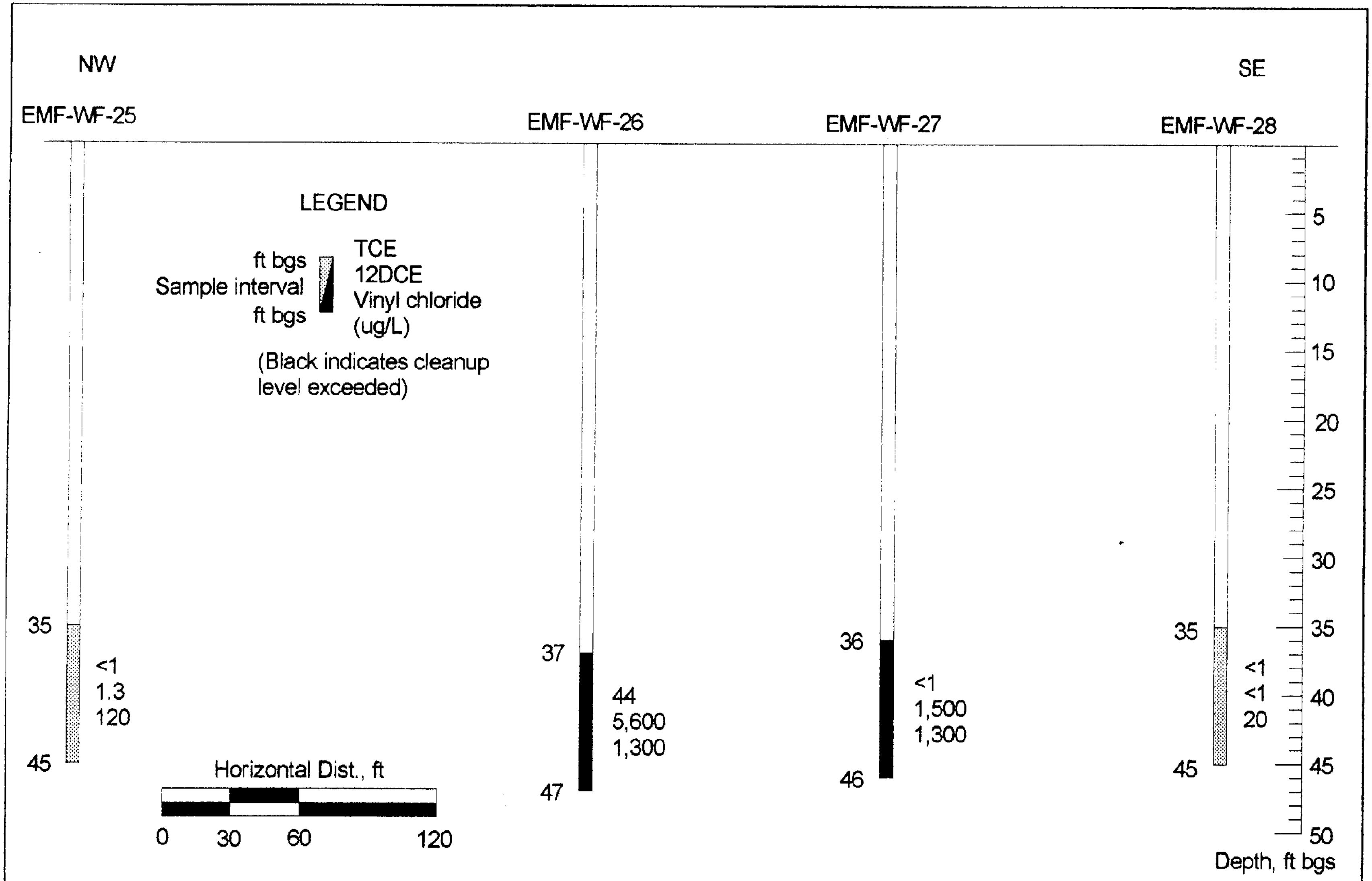

Figure 4. Analytical Results from Monitoring Well Sampling near Fenceline with East Marginal Way

KCSlip4 43877

SEA410407

3.0 SAMPLING APPROACH

The next phase will include Geoprobe sampling and installation of monitoring wells near the expected central area of the plume. These efforts are described below. All sample collection and analysis activities will be performed in accordance with the Project Quality Assurance Project Plan (PPC 1999). All waste materials generated will be handled in accordance with the Project Waste Management Plan (PPC 2001) and other Boeing procedures as required.

3.1 Phase V Sampling

The objective of the Phase V sampling is to locate the VOC plume and to identify the peak VOC concentrations in the central area of the plume within two areas:
1) the parking area on the east side of Plant II (designated Area 1), and
2) an accessible area along 16th Ave closer to the Duwamish Waterway (designated Area 2)

This investigation will include collection of multiple water samples over depth using a direct push Geoprobe rig to collect discrete samples over depth. Previous sampling at up-gradient locations has shown the VOC plume to be stratified in the interval approximately 35 to 45 feet below ground surface (bgs). The Phase V Geoprobe samples will be collected within this interval, with limited additional samples collected above and below this interval. The planned sampling locations are shown in Figure 5. The sampling locations in the Area 1 vicinity are designated WF-16, WF-17, WF-18, WF-19 and WF-20. The initially planned sampling locations in the Area 2 vicinity are designated WF-21, WF-22, WF-23, WF-24 and WF-25. These Area 2 locations shown in Figure 5 may be moved after the analytical results from the Area 1 sampling are reviewed and evaluated.

3.1.1 Water Samples
The water samples will be collected in 40-mL septum-top VOA vials with no headspace, preserved with hydrochloric acid, placed in a cooler and maintained under chain-of-custody for delivery to the analytical laboratory. The estimated number of samples to be collected for VOC analysis during the Phase V Geoprobe sampling is forty (40).

3.1.2 Soil Samples
Soil samples will also be collected for grain size analysis and these data will be used for relative comparison with data collected from up-gradient locations. The estimated number of samples to be collected for grain size analysis is fifteen (15).

3.2 Installation of Monitoring Wells

Six new monitoring wells (each a 2-inch well) are planned after the Geoprobe data are collected/evaluated (3 wells in Area 1 and 3 wells in Area 2). The location for each monitoring well will be determined after the analytical results from the Geoprobe sampling are evaluated. The locations will also be adjusted as necessary based on the results of a location survey for underground utilities.

KCSlip4 43878

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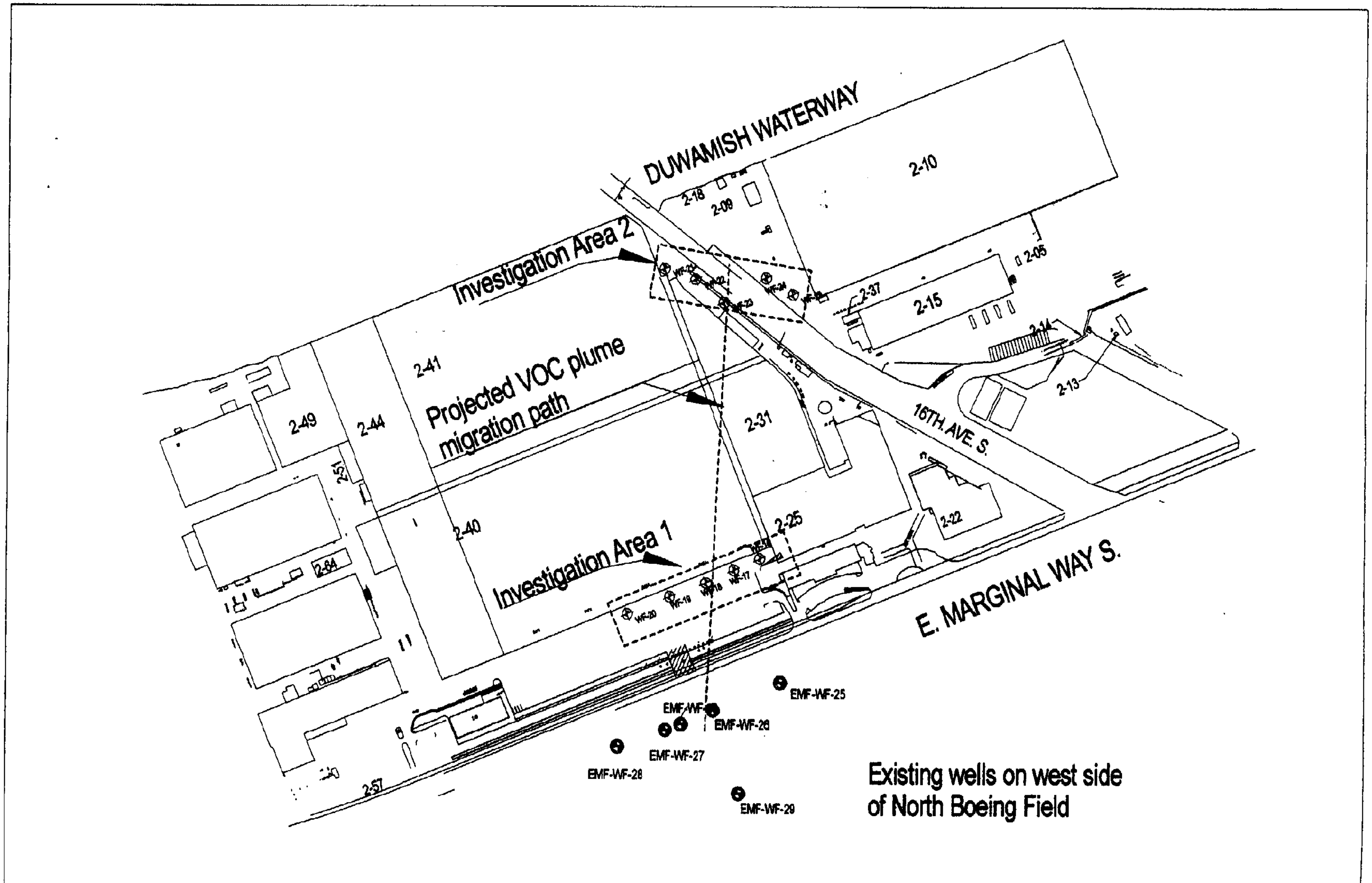

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Geoprobe Sampling Location

Monitoring well location (existing)

200' 100' 0 200' 400'

APPROXIMATE SCALE IN FEET

Figure 5. Planned Phase V Sampling Locations EMF Plume, West Side of East Marginal Way

KCSlip4 43879

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After the monitoring wells are installed, each will be developed using a surge and pump method until the extracted water is visually free of suspended sand/silt particles.

4.0 ANALYTICAL METHODS

Groundwater samples will be submitted for VOC analysis by Environmental Protection Agency (EPA) SW-846 Method 8260 at a laboratory accredited by Washington Department of Ecology (expected to be the Boeing Environmental Analysis Laboratory [EAL] or ARI, both accredited laboratories) . The quantitation limit for VOCs of concern using Method 8260 method is expected to be in the range of 1 to 2 μg/L. The samples submitted to the laboratory will be analyzed on a standard turnaround basis (7 to 14 days).

5.0 QUALITY ASSURANCE

All sampling, laboratory analysis, and data evaluation will be completed in compliance with the Project Quality Assurance Plan (QAP)(PPC 1999). The Project QAP is attached. The analytical method to be used (8260B) is a standard EPA method contained in *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846.*

The samples will be submitted to a laboratory certified for the specific analytical method to be completed. The sampling will include field duplicates and trip blanks. All sample bottles will be labeled with a unique identification and logged into the chain-of-custody form at the time the samples are collected.

6.0 MANAGEMENT OF INVESTIGATION DERIVED WASTES

All waste materials generated will be containerized, labeled, sampled for characterization and disposed of in compliance with the Project Waste Management Plan(PPC 2001) and any other applicable Boeing procedures that are identified. The Project Waste Management Plan is attached.

Quality Assurance Plan for Environmental Sampling at Boeing Sites

prepared by
PROJECT PERFORMANCE CORPORATION
May 18 1999

KCSlip4 43881

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1.0 QUALITY ASSURANCE PROJECT PLAN

1.1 Introduction and Objectives

This Quality Assurance Project Plan (QAPjP) describes activities that will be implemented to assure integration of applicable Quality Assurance/Quality Control (QA/QC) requirements into sampling activities conducted in support of field investigations. The objective of this QAPjP is to present procedures, organization, objectives, functional activities, and specific QA/QC activities to assure that data collected during field activities are of known and sufficient quality to meet project objectives.

1.2 Measurements

Measurements will be made to collect both screening data and definitive data needed to meet project objectives. In general, screening data will be collected using field analytical methods and definitive data using laboratory analytical methods. Examples of measurements commonly performed and associated data quality levels are summarized in Table 1-1.

1.3 Quality Assurance Organization and Key Personnel

The Site Manager (SM) will be in direct contact with the client's Project Manager (PM). The SM is fully responsible for the technical quality of the work, as well as project budget and schedule. He will direct, coordinate, and monitor the efforts of the Site Team members to assure the technical quality of the work and accurate reporting to management. Specific responsibilities related to QA/QC include:

- Assure availability of technical standard operating procedures (SOPs) and training of staff to SOPs;
- Prepare project work implementation plan (WIP);
- Assure project activities are conducted according to SOP/QAPjP;
- Review and evaluate data and verify data quality;
- Implement corrective actions resulting from QA audits;
- Report QA problems to client's PM; and

- Supervise preparation of project deliverables.

Table 1-1. Examples of Measurements

Measurement Type	Data Collected	Data Quality Level
Laboratory Analytical Measurements	Concentrations of VOCs in groundwater samples.	III
	Concentrations of semivolatile organics in groundwater samples.	III
	Concentrations of metals in groundwater samples.	III
	Concentrations of VOCs in soil samples.	III
	Concentrations of semivolatiles in soil samples.	III
	Concentrations of PCBs in sediment/soil samples.	III
	Concentrations of metals in soil samples.	III
Field Analytical Measurements	Concentration of dissolved oxygen (DO) in groundwater samples.	I
	Hydrogen ion activity (pH) of groundwater samples.	I
	Oxidation-reduction potential (ORP) of groundwater samples.	I
	Specific conductance of groundwater samples.	I
	Temperature of groundwater samples.	I
Field Physical Measurements	Instantaneous pumping rate of groundwater in DDC well.	N/A
	Piezometric head in DDC well and monitoring wells.	N/A
	Air injection and extraction rates.	N/A

The SM reports quality issues to the Quality Assurance Manager (QAM) and technical issues to the Vice President of Environmental Engineering and Technical Development at Project Performance Corporation.

KCSlip4 43883

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The Quality Assurance Manager (QAM) is responsible for developing and implementing the project QA program. The QAM will communicate QA responsibilities to all project staff and provide guidance for implementation of the QAPjP. The QAM has authority to terminate the project activities if the quality of data is jeopardized. Specific responsibilities of the QAM related to QA /QC include:

- Serve as point-of-contact for all matters involving QA;
- Provide guidance and technical information concerning QA issues to project staff;
- Review project activities for proper implementation of the WIP and SOP;
- Plan and conduct QA audits; and
- Identify QA deficiencies to SM and assist in identification of corrective actions.

The QAM reports to the Vice President of Environmental Engineering and Technical Development at Project Performance Corporation.

The Field Supervisor (FS) will provide day-to-day supervision of all field sampling and analysis activities. Specific responsibilities of the FS related to QA/QC include:

- Supervise all field sampling and analysis activities to assure proper implementation of SOP;
- Supervise sample collection and logging and documentation of field activities and test results;
- Assure all field activities identified in work plan are implemented, required environmental and QC samples are collected, and required field measurements are taken;
- Coordinate with analytical laboratory(ies) for scheduling of analyses and receipt of samples;
- Supervise subcontractor staff involved with field activities; and
- Coordinate transfer of field data and records to SM for data reduction and validation.

The FS reports to the SM. If the FS cannot be present during certain field activities, the SM will designate an alternate FS for those activities. The alternate FS will have all responsibilities identified above.

Field technicians (FTs) will report to and perform field sampling and analysis activities under the supervision of the FS. Responsibilities of the FT related to QA/QC include:

- Perform field tasks according to WIP and applicable SOP; and
- Prepare and maintain records of field activities.

Field engineers/scientists (FES) will perform field activities other than routine sampling and analysis. These activities include well logging, supervising installation of wells, performing aquifer tests, and installing and starting up treatment and test equipment. Responsibilities related to QA/QC include:

- Conduct activities in accordance with WIP and applicable SOP;
- Coordinate activities with FS to assure integration of field operations; and
- Generate and maintain documentation of field activities and test results.

1.4 Data Quality Objectives

Data quality objectives (DQOs) describe the quality of data needed to meet project objectives. The DQOs depend on how the data will be used. Analytical data will generally be used to identify the areal extent and types and concentrations of contaminants. Important parameters associated with the data quality are quantitation limit, precision, accuracy, representativeness, comparability, and completeness. These are discussed below.

1.4.1 Quantitation Limit

The sensitivity of analytical methods is expressed as the quantitation limit. In order for analytical data to be of sufficient quality, the quantitation limit of the analytical method used must be less than the quantitation limit required to meet project objectives. The former depends on site-specific matrix effects and is commonly expressed as the estimated quantitation limit (EQL). Examples of EQLs for the methods and matrices specified for this project are summarized in Table 1-2. The required quantitation limit is related to the use of the data.

KCSlip4 43885

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Table 1-2. Examples of Laboratory Analytical Methods, Performance, and Quality Goals

Analyte	Matrix	Method	EQL	Precision		Accuracy	
				LCS/LCS DRPD	MS/MSD RPD	LCS % Recovery	MS % Recovery
Volatiles	Groundwater	SW8260	2 μg/L	<55	<27	50 - 150	50 - 125
SemiVolatiles	Groundwater	SW8270	5 ug/L	<50	<25	50-150	50-125
Metals, in general	Groundwater	SW6010	50 - 100 ug/l	<20	<20	75-125	75 - 125
Metals, in general	Soil	SW6010/3050	1 mg/kg	<30	N/A[(a)]	75 - 125	N/A[(a)]
Volatiles	Soil	8260/5030	0.1 mg/kg	<30	N/A[(a)]	75 - 125	N/A[(a)]
SemiVolatiles	Soil	8270/3540	0.1 mg/kg	<30	N/A[(a)]	76 - 110	N/A[(a)]
PCB (arochlor 1254)	Soil	8082	10 μg/kg	<30	N/A[(a)]	26-167	N/A[(a)]

Acronyms and Notes:

LCS/LCSD Laboratory control sample/laboratory control sample duplicate
MS/MSD Matrix spike/matrix spike duplicate
RPD Relative percent difference

(a) Matrix spikes will not be performed.

KCSlip4 43886
SEA410416

1.4.2 Precision

Analytical precision is calculated by expressing, as a percentage, the difference between the results of analysis of duplicate samples relative to the average of those results for a given analyte. Precision is expressed as the relative percent difference (RPD). Examples of the required RPD for each method and matrix are presented in Table 1-2.

1.4.3 Accuracy

Analytical accuracy is calculated by expressing, as a percent, the recovery of a standard reference material or an analyte that has been added to the sample (or standard matrix) at a known concentration before analysis. Examples of the required recovery are specified in Table 1-2. The spiked (fortified) concentration used will be specified by laboratory quality control requirements as detailed in the analytical method. Samples for matrix spikes will be collected at the frequency specified in the project objectives.

1.4.4 Representativeness, Completeness, and Comparability

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Data representativeness will be attained through the proper design of the sampling program.

Completeness is a measure of the relative number of analytical data points that meet all the acceptance criteria for accuracy, precision, and any other criterion required by the specific analytical methods used. Data completeness is affected by laboratory accidents, insufficient sample volume, or sample breakage during shipment, etc. The quality assurance objective for analytical data completeness is 95%. To help assure completeness, chain-of-custody (COC) forms will be used to document and trace possession of samples from the time of collection through delivery to the analytical laboratory. The COC form is shown in Figure 1-1.

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P O Box ' `9 M/S 8J-55
Seattle, \ 98124-2499
Ph. 773-8934

Figure 1-1. Chain-of-Custody Form

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CHAIN OF CUSTODY RECORD/LABORATORY ANALYSIS REQUEST

(Shaded areas to be completed by lab personnel.)

REPORT TO	ORGN.	MAIL STOP	PHONE	CHARGELINE/CONTROL NUMBER
CC:	ORGN.	MAIL STOP	SAMPLERS:	

SAMPLE DESCRIPTION AND LOCATION (INCLUDE PLANT, BLDG. #, SITE, SAMPLE #, ETC.)	SAMP DATE	TIME	MATX	COLL TYPE	No. CONT	LAB ID (LAB USE ONLY)	ANALYSIS REQUESTED (Please indicate method numbers. Use codes on back to indicate tests.)

Comments/Special Instructions	Relinquished by (SIGNATURE)	Relinquished by (SIGNATURE)	Relinquished by (SIGNATURE)
	Printed Name	Printed Name	Printed Name
	Company	Company	Company
	Date Time	Date Time	Date Time
	Received by (SIGNATURE)	Received by (SIGNATURE)	Received by (SIGNATURE)
	Printed Name	Printed Name	Printed Name
	Company	Company	Company
	Date Time	Date Time	Date Time
JOB ID.	Custody Seal(s) ☐ present ☐ intact		

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KCSlip4 43888

SEA410418

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be achieved through the use of standard sampling and analytical techniques. Data results will be reported in appropriate units consistent with existing site data and applicable regulatory levels.

1.5 Analytical Procedures and Calibration

1.5.1 Laboratory Procedures

Groundwater and soil samples collected will be analyzed according to standard methods such as EPA Method 8260 and other analytical methods specified in Table 1-2. All changes and modifications to procedures will be documented thoroughly in the narrative summary for the data package. All parameters specified by the analytical methods will be determined. Compounds may be added to subsequent analyses if they are identified and judged to be of concern.

1.5.2 Laboratory Equipment Calibration

Before any instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements will be made within the calibrated range of the instrument.

Routine calibration standards will be used in the analytical laboratory(ies) to demonstrate that the performance of an instrument does not cause unnecessary error in the analysis. This calibration will indicate instrument stability and sensitivity. The methods for verification and documentation of instrument conditions prior to and during testing will be described by the analytical laboratory(ies) in specific laboratory procedures.

Laboratory instrument calibrations typically consist of two types, initial calibration and continuing calibration. Initial and continuing calibration criteria must meet the method acceptance criteria before sample analysis can begin. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is expressed as a correlation coefficient (e.g. for atomic absorption, inductively coupled plasma, UV-visible/infrared spectrophotometry, ion chromatography) or by a response factor, amount/response (e.g., for gas chromatography, gas chromatography/mass spectrometry, high performance liquid chromatography).

Continuing calibration usually includes measurement of the instrument response to one or more calibration standards and requires instrument response to compare within certain limits (e.g., ±10%) of the initial measured instrument response. Continuing calibration is performed at least once per operating shift for all analyses.

Specific instrument calibration procedures for various analytical instruments are described in detail in analytical procedures.

1.5.3 Field Analytical Procedures

Field analytical procedures will be employed to determine DO concentration, ORP, pH, specific conductance, and temperature of groundwater samples. Such analyses will be performed using procedures contained in EPA's Methods for Chemical Analysis of Water and Wastewater and the latest edition of Standard Methods for the Examination of Water and Wastewater.

1.5.4 Field Equipment Calibration

All instruments and equipment used to perform field measurements will be operated, calibrated, and maintained according to manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel who have been properly trained in these procedures.

1.6 Data Reduction, Validation, and Reporting

1.6.1 Data Reduction

Data reduction consists of those activities involving conversion of raw data to reportable units, transfer of data between recording media, and computation of summary statistics, standard errors, confidence intervals, tests of hypotheses relative to the parameters, and model validation. Statistically-acceptable data analysis procedures will be implemented for all data reduction steps.

Laboratory Data Reduction

Laboratory data reduction will be performed according to requirements established by PPC and the client.

Field Technical Data Reduction

Field technical data (i.e., non-laboratory generated) can generally be characterized as either objective or subjective data. Objective data include all direct measurements such as field analyses and water level measurements. Subjective data include descriptions and observations. Some activities, for example, test boring and well logs, include both types of data in that the data recorded in the field are descriptive but can be reduced using the standardized lithologic coding system.

All field data necessary to meet project objectives will be recorded by field personnel. As appropriate, field data will be recorded on forms included with SOP. At the completion of a task, copies of all field records will be checked and the data reduced to tabular form wherever possible by entering the data into database files. Subjective data will be filed as hard copies for incorporation into technical reports as appropriate.

The project work plan describes how the data collected during the project will be analyzed to meet specific project objectives. All calculations will be performed on standard calculation sheets that will include the name of the person performing the calculations and the date of the calculations. All calculations will be checked by a second person. This person's name and the date that the calculations were checked will be entered on each calculation sheet. All calculation sheets will be retained in the project file.

1.6.2 Data Validation

Data validation, an after-the-fact review of data, is the process whereby data are determined to be of acceptable or unacceptable quality based on a set of predefined criteria. These criteria depend upon the type(s) of data involved and the purpose for which data are collected.

Laboratory Data Validation

Laboratory data review will be performed as described in the data review preview procedures stipulated in PPC's QAPP.

Field Data Validation

Validation of objective field and technical data will be performed at two different levels. On the first level, data will be validated at the time of collection by following standard procedures and quality control checks. At the second level, data will be validated by the SM or his designee who will review the data to ensure that the correct codes and units have been included. After data reduction into tables or arrays, the SM will review data sets for anomalous values. Any inconsistencies or anomalies discovered by the SM will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for collecting the data.

Subjective field and technical data will be validated by the SM, who will review field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made to confirm the recorded observations. Whenever possible, peer review will also be incorporated into the data validation process, particularly for subjective data, to maximize consistency among field personnel. For example, during drilling activities, the SM may schedule periodic reviews of archived lithologic samples to ensure that the appropriate lithologic descriptions and codes are being consistently applied by all field personnel. In addition, for field analyses and tests, an independent review of the applicable items described previously for laboratory data validation will be conducted (e.g., calibration methods, control limits, instrument checks, etc.). A record of field data validation will be made using the data validation/review form contained in PPC's QAPP.

1.6.3 Data Reporting

Analytical Laboratory

Laboratory analyses will be analytical level III (see Table 1-1). As a result, Contract Laboratory Program (CLP) data packages are not required. The standard analytical laboratory data reports for organic and inorganic analyses will consist of a transmittal letter and the following, as appropriate for the analyses performed:

- cover page describing data qualifiers, sample collection, sample receipt, extraction and analysis dates, and a description of any technical problems encountered with the analyses;
- copies of the chain-of-custody forms;
- copies of the analytical forms;
- spreadsheet sample analytical results and quality control summaries;
- calculated recoveries for all quality control samples, method duplicate or duplicate spike and method blank results;
- all laboratory quality control data including method blank, method blank spike, matrix spike, laboratory duplicate or spike duplicate, and surrogate recovery data;
- method quantitation limits for all parameters and dilutions; and
- five-peak library search report for GC/MS volatiles and semi-volatiles.

Analytical results will be reported in μg/L for aqueous samples, mg/kg for soil samples, and ppbv for gas samples.

Non-analytical data will consist of results of physical measurements or tests (e.g., aquifer tests). The results of these tests will be reported in the formats and units indicated in the specific procedure used.

1.7 Internal Quality Control Checks

Internal quality control checks will allow evaluation of the consistency and validity of generated data.

1.7.1 Laboratory Analytical Activities

Internal quality control of laboratory analyses will conform to EPA requirements for CLP laboratories.

1.7.2 Field Sampling Quality Control Activities

Quality control activities for field sampling provides a means of evaluating the integrity of a sample from the time of collection through analysis at an approved laboratory. Field sampling quality control activities involve maintenance of chain-of-custody, documentation of activities, use of appropriate sample containers and preservatives, submission of samples to laboratories in a timely manner, use of a consistent sample numbering system, and collection of appropriate quality control samples. These activities are discussed in more detail below.

Chain-of-custody involves documenting the possession and handling of a sample from the time of

KCSlip4 43892

SEA410422

collection through analysis. This documentation will be made through use of the chain-of-custody forms (Figure 1-1). In addition to the chain-of-custody forms, a master sample logbook will be maintained for all samples collected during the project.

Standard operating procedures (SOPs) specify requirements for collection of field data. Forms for collecting most field data are contained in the SOPs. Any additional data collected will be recorded in personal or field team logbooks.

Field team members will keep accurate written records of sample collection activities and other field data collection activities. All data entries will be legible and will be written in waterproof ink. All entries will be dated and initialed. Errors will not be erased but will be crossed out with a single line and the change initialed and dated.

Sample containers, preservatives, storage requirements, and holding times are summarized in Table 1-3. Samples from nonpermanent locations (e.g., soil borings) will be identified using the following 10-character identification scheme:

AABBBCCNNN

where:

AA are two alpha characters identifying the type of site;

BBB are three alpha-numeric characters designating the site;

CC are two alpha characters identifying the type of sample; and

XXX are three numeric characters identifying the sample location.

Samples from monitoring wells will be identified using the permanent location designation assigned by the client point of contact or the groundwater sampling and analysis program point of contact.

KCSlip4 43893

SEA410423

Table 1-3. Summary of Sample Handling, Preservation, and Storage Requirements

Analysis	Matrix	Container	Preservative	Storage Requirements	Holding Time
Volatiles, SW8260	Groundwater	3 40-mL glass vials with Teflon-lined caps	pH < 2 with HCl	4°C	14 days
Semivolatiles, SW8270	Groundwater	2 1-L glass bottles with Teflon-lined caps	None	4°C	7 days until extraction, 40 days after extraction
Metals, general, SW6010	Groundwater	1 500-mL polyethylene bottle	pH < 2 with HNO_3	None	6 months
Volatiles, SW8260/5030	Soil	1 500-mL Wide-Mouth jar	None	4°C	7 days until extraction, 14 days after extraction
Semivolatiles, SW8270/3510	Soil	1 500-mL Wide-Mouth Jar	None	4°C	7 days until extraction, 50 days after extraction
Metals, general, SW6010/3050	Soil	1 500-mL Wide-Mouth Jar	None	4°C	30 days until extraction, 6 months after extraction
PCBs 8082	Soil	1 500 mL wide-mouth jar	None	4°C	14 days until extraction, 6 months after extraction

KCSlip4 43894
SEA410424

The quality control samples that will be collected are summarized in Table 1-4 and described below.

Field replicate soil, groundwater, and gas samples will be given a unique alphanumeric identifier and submitted to the laboratory blind, (i.e., without indicating the location). These samples will serve as blind field splits and will be used to evaluate laboratory reproducibility and field reproducibility.

Equipment (rinsate) blanks will be included as part of the field QA/QC program for groundwater sampling activities. These samples will serve as a check on the sampling device cleanliness.

Ambient blanks and trip blanks will be included for analysis of groundwater samples for VOCs. Ambient blanks are collected by pouring organic-free water into a sample container in the field at the time and location of sampling. These blanks are used to assess the potential for contamination of samples by ambient sources. Trip blanks are prepared in the laboratory and consists of organic-free water that is placed in the same type of sample container as the groundwater samples. The trip blanks are transported to the field and handled and packaged in the same manner as the groundwater samples. Trip blanks serve as a check on sample contamination originating from sample transport, shipping, and from site conditions.

Additional sample volume will be required to perform matrix spikes and matrix spike duplicates (MS/MSD) for water samples being analyzed for volatiles (SW8260), semivolatiles (SW8270), metals (SW6010), and alkalinity (E310.1). Samples for MS/MSD will consist of three times the normal sample volume specified in Table 1-3. Samples for MS/MSD will be collected at a frequency of one per 20 samples or one per analytical batch, whichever is more frequent.

1.8 Performance and System Audits

The requirement for systems audits for the field activities associated with project will be satisfied, in part, by approval of this QAPjP and all procedures referenced therein. In addition, field activities will be monitored by the project QAM to ensure compliance with the requirements of this QAPjP.

An on-site audit of project-specific monitoring activities will be conducted at least once per project by an PPC staff member not otherwise involved in the activities being audited. The focus of the audit will be on actual QC activities of data collection, and will use the QAPP as a reference. The sampling systems audit checklists

KCSlip4 43895

SEA410425

Table 1-4. Summary of Field Quality Control Samples

QC Sample Type	Sample Matrix	Applicable Analysis	Frequency	Purpose	Acceptance Criteria	Corrective Action
Field Duplicate	Groundwater	SW8260	One per 20 samples or sample batch	Monitor sample variability	<50% RPD	Evaluate source of variability. Evaluate whether sampling frequency needs to be increased.
		SW8270			<50% RPD	
		SW6010			<30% RPD	
	Soil	SW8260			<100% RPD	
		SW8270			<100% RPD	
		SW6010			<100% RPD	
		SW 8082			<100% RPD	
Ambient Blank	Water	SW8260	One per 20 samples	Monitor potential for contamination from ambient sources	See note (a)	Evaluate source of contamination and determine procedure change, if needed.

KCSlip4 43896
SEA410426

Table 1-4. Summary of Field Quality Control Samples (Continued)

QC Sample Type	Sample Matrix	Applicable Analysis	Frequency	Purpose	Acceptance Criteria	Corrective Action
Equipment Rinsate Blank	Groundwater	SW8260	One per 20 samples	Monitor decontamination effectiveness and sample cross contamination	See note (a)	Evaluate source of contamination and determine procedure changes, if needed.
		SW8270				
		SW6010				
		E300.0				
Trip Blank	Groundwater	SW8260	One per sample shipment	Monitor contamination from sample handling and shipment	See note (a)	Evaluate source of contamination and determine procedure changes, if needed.

Notes:

(a) Sample must exhibit contaminant at a level equal to or greater than 5 times the quantitation limit to be considered detectable.

KCSlip4 43897
SEA410427

contained in the QAPP will be used as appropriate to the activities being audited. The following specific activities will be reviewed in the audit:

- Sample collection and analytical activities;
- Equipment calibration techniques and records;
- Decontamination and equipment cleaning;
- Equipment suitability and maintenance/repair;
- Background and training of personnel;
- QC samples; and
- Sample containers, preservation techniques, and chain-of-custody.

The requirements for performance audits will be satisfied by taking measures to ensure measurement accuracies are being achieved and maintained. These measures primarily include the provisions identified in Section 1.7 of this QAPjP including the submission of blanks and duplicate samples for analysis. The performance of these activities will be performed or witnessed, as appropriate, by the QAM.

1.9 Corrective Action Plan

Corrective action is initiated when the following situations arise:

- Specific requirements of the analysis method or sampling/analysis procedure are not met;

- Data quality objectives for precision, accuracy, and completeness are not achieved; and/or

- Laboratory or field data review indicates that data are incomplete or that improper calculation, methodology, or technique was employed, or that an instrument malfunction has occurred.

When deficiencies are found, the QAM and SM will determine if the data in question are essential to the project and what corrective action will be taken. Corrective action may include one or more of the following:

- Additional information or recalculations are supplied.

- Instrument operation and calibration are checked. Calibration standards are checked and new standards are obtained, if necessary. Instrument malfunctions are corrected.

- Personnel repeat the task using the same procedure.

- A different individual repeats the task using the same procedure.

- Samples are re-analyzed (if holding time permits).

- Sampling and/or analytical procedures are evaluated and amended.

- Personnel repeat the task using a validated new or modified procedure.

- If practical, a new sample is collected and analyzed.

If the anomaly is not resolved after the above steps are taken, the data are reported with qualifying statements. In some cases, depending on the nature and degree of deviation, no data may be reported.

1.9.1 Laboratory Corrective Action

The initial responsibility for monitoring the quality of an analytical system lies with the analyst. The analyst will verify that all quality control procedures are followed and that the results of analysis of quality samples are within acceptance criteria. This requires that the analyst assess the correctness of all the following items, as appropriate:

- sample preparation procedures,
- initial calibration,
- calibration verification,
- method blank result, and
- laboratory control standard.

If the assessment by the analyst reveals that any of the quality control acceptance criteria, as defined by the most recent edition and updates of the analytical method are not met, the analyst must immediately assess the analytical system to correct the deficiency. The analyst must notify his/her supervisor and the laboratory quality assurance coordinator of the deficiency and, if possible, identity potential causes and corrective action. Analytical data quality concerns that may require corrective action will be identified using the analytical request form described in the QAPP.

The nature of the corrective action obviously depends on the nature of the deficiency. For example, if a continuing calibration verification is determined to be out of control, the corrective action may require recalibration of the analytical system and re-analysis of all samples since the last acceptable continuing calibration standard.

Quality control samples (e.g., matrix spikes and matrix spike duplicates) provide an indication of matrix affects on analyses. Failure to achieve method specific performance on quality control samples will trigger corrective action or additional re-analysis, as appropriate.

When the appropriate corrective action measures have been defined and the analytical system is determined to be in control, the analyst will document the problem, the corrective action, and the data demonstrating that the analytical system is in control. Copies of this documentation will be provided to the laboratory supervisor and the laboratory quality assurance coordinator.

1.9.2 Field Corrective Action

The initial responsibility for monitoring the quality of field measurements and observations lies

KCSlip4 43899

SEA410429

with the field personnel. The FS is responsible for verifying that all quality control procedures are followed. This requires that the FS assess the correctness of field methods and the ability to meet quality assurance objectives. If a deficiency occurs that might jeopardize the integrity of the project or cause some specific quality assurance objective not to be met, it is the responsibility of all field project staff to report it.

1.10 Analytical Laboratory Requirements

The analytical laboratory(ies) will be responsible for performing all analyses exactly as specified in the appropriate analytical methods. The analytical methods to be performed are summarized in Table 1-2. In addition, the analytical laboratory(ies) must comply with applicable requirements of this QAPjP, including the following:

- Equipment Calibration (Section 1.5.2),
- Data Reduction (Section 1.6.1),
- Data Validation (Section 1.6.2),
- Data Reporting (Section 1.6.3),
- Internal Quality Control Checks (Section 1.7.1), and
- Corrective Action (Section 1.9.1).

KCSlip4 43900

SEA410430

INVESTIGATION DERIVED WASTE MANAGEMENT PLAN

1.0 POLICY AND RESPONSIBILITIES

This plan has been developed to identify responsibilities and provide Project Performance Corporation (PPC) with procedures to manage investigation derived wastes (IDW) in compliance with State, and Federal regulations and Boeing's internal waste management procedures. This plan also applies to all subcontractor personnel that may work for PPC as part of this project.

1.1 *Waste Management Responsibilities*

The specific procedures in this plan are applicable for any dangerous waste generated exclusively by PPC (and PPC's subcontractors) as a result of work at the site. The Boeing Company will assume management responsibility for any dangerous wastes derived from existing dangerous wastes present at the site. If PPC (or PPC's subcontractors) generate dangerous wastes that are derived from existing dangerous wastes present at the site, they will be responsible only for placing these wastes in appropriate containers as they are generated.

Most of the IDW will be generated during construction and installation (drill cuttings and purge water), and aquifer testing. A smaller amount of spent activated carbon may be generated if any treatment before disposal is required. Any of these wastes that are dangerous are expected to be so because they are derived from existing dangerous wastes present at the site. Examples include environmental media (drill cuttings and purge water) containing dangerous wastes formerly disposed of at the site. PPC personnel will coordinate closely with Boeing staff to assure that these materials are managed in accordance with applicable requirements. The ultimate storage, treatment, and/or disposal of any dangerous wastes derived from existing dangerous wastes present at the site will be the responsibility of Boeing.

1.2 Personnel Responsibilities

The PPC Site Manager for this project is Tom McKeon. He is responsible for oversight of all dangerous waste management activities during this project and is responsible for implementing the waste management procedures in compliance with Facility, State and Federal regulations. The PPC Quality Assurance Manager, Dr. Rick Shangraw, is responsible for review of all waste management procedures that are implemented. In the event that QA review of procedures identifies any problems or discrepancies with the implementation of the waste management procedures, Dr. Shangraw will identify procedural changes required to address any identified problems. If any problems are identified, procedural changes required will be presented to the entire project team including any subcontractor personnel.

2.0 GENERAL PROCEDURES

No dangerous waste will be imported onto the Facility by PPC. Some of the materials, instruments and equipment that may be used on the site as part of this project may contain substances listed in WAC 173-303-081. These substances, if discarded, spilled, or spent, are considered dangerous wastes. If any materials containing such hazardous substances are spilled or otherwise handled in a manner that generates a dangerous waste, the dangerous waste management procedures described in this plan will be followed.

The expected types of materials that will be brought on the site by PPC include drilling materials (bentonite, hydraulic fluids and oil for equipment, etc.), calibration gases for field instruments, potentially a groundwater tracer (lithium bromide), and other equipment/materials that may contain small quantities of hazardous substances.

2.1 Facility Notification

Prior to importing any materials on to the site which contain hazardous substances as defined above, the Boeing Project Manager will be notified. At the direction of the Boeing Project Manager, additional personnel at the site (e.g., Fire Department or others) will also be notified regarding the nature of the material and the quantity, location, and method of storage.

In the event that any dangerous waste is generated, the Boeing Project Manager and field supervision staff will be will be notified as soon as practical (i.e., following implementation of any emergency response/containment measures).

2.2 Implementation

If any hazardous substance is spilled or otherwise becomes a waste that is the responsibility of PPC on this project, follow the following procedures will be followed:

1. Prior to generating the waste determine, based on best available existing information and the criteria contained in Section 3.0, whether the waste will be dangerous, nondangerous, or potentially dangerous.

2. If a spill has occurred, implement the spill control and contingency (SPCC) plans described in the Facility SPCC Plan.

3. Notify the Boeing Project Manager and field supervision staff of the event generating the waste.

4. Containerize the waste material in appropriate containers and label all containers with appropriate labels describing the drum/container ID number, contractors name, date that waste materials were placed in the container, expected waste material contents in the container, point of contact, and general site location. If, based on the determination described in Step 1), the waste is known to be dangerous, complete and attach a "Hazardous Waste" label. If sampling and analysis data are needed to determine whether the waste is dangerous, attach "Pending Analysis" label.

5. Conduct a review of operating procedures to determine the cause of the waste generation and evaluate operational/equipment/process changes that will eliminate or reduce the potential for further waste generation.

6. Upon receipt of required analytical data, determine whether the waste is dangerous as described in Section 3.0. Evaluate the regulatory requirements for proper packing, labeling, storage, transportation and disposal of any dangerous waste.

7. After concurrence with the Boeing Project Manager and field supervision staff, arrange for proper disposal of the waste material in compliance with applicable regulations.

3.0 IDENTIFICATION OF WASTES

If a waste material is generated, it must be evaluated to determine if it is a dangerous waste. The procedure used for designating dangerous waste is described in WAC 173-303-070(3)and involves four steps. First, the waste must be evaluated to determine whether it is a discarded chemical product listed in WAC 173-303-9903. If not, it must then be evaluated to determine whether it is from a waste source listed in WAC 173-303-9904. If the waste is a listed dangerous waste, it must then be evaluated to determine whether it exhibits any of the characteristics of dangerous wastes given in WAC 173-303-090. Finally, if the waste is not a listed waste or characteristic waste, it must be evaluated to determine whether is meets the criteria for dangerous wastes given in WAC 173-303-100. These dangerous waste designations are described below.

3.1 Listed Wastes

Certain classes of hazardous wastes are considered listed wastes because exhibit the characteristics of hazardous wastes or contain toxic constituents. The listed wastes include the following:

1. **P-List.** WAC 173-303-9903 lists acutely hazardous commercial chemical products that are classified as dangerous wastes if discarded or spilled. No P-List products are expected to be used by PPC during this project.

2. **U-List.** WAC 173-303-9903 also lists hazardous commercial chemical products that are classified as dangerous wastes if discarded or spilled. No U-List products are expected to be used by PPC during this project.

3. **F-List.** 173-303-9904 lists dangerous wastes from nonspecific sources, primarily generic manufacturing and processing wastes such as spent solvents. No F-List wastes are expected to be generated exclusively by PPC during this project. If degreasing must be performed, nonhazardous solvents (e.g., limonene) will be used.

4. **K-List.** WAC 173-303-9904 also lists dangerous wastes from specific sources, primarily wood preserving, petroleum refining and chemical manufacturing. No K-List wastes will be generated exclusively by PPC during this project.

As described in WAC 173-303-081(3) and 173-303-082(3) wastes that are mixed with listed dangerous wastes are also generally considered to be dangerous wastes. These types of dangerous wastes may be generated during this project. For example, if drill cuttings contain TCE and the source of the TCE is a spent solvent that was spilled or disposed of at the site, then the drill cuttings will be listed dangerous waste. Similarly, spent activated carbon from treating air stripper off gas may be listed waste if it contains TCE that was spilled or disposed of as a spent solvent. If PPC was not responsible for generating the original listed waste (in this case the spent solvent) then PPC will not have management responsibility for the "dangerous waste mixture."

3.2 Characteristic Wastes

If a waste is not a listed dangerous waste it may be a dangerous waste if it exhibits the characteristics of dangerous wastes. The characteristics of dangerous wastes are as follows.

1. **Ignitability.** WAC 173-303-090(5) describes the characteristic of ignitability. Ignitable characteristic wastes include liquids with low flash points (< 60 C), and ignitable

compressed gases and oxidizers, as identified by Department of Transportation (DOT) regulations (49 CFR 173). Sodium and potassium permanganate and sodium and potassium peroxydisulfate may be used during the project and all are classified as oxidizers by DOT regulations. Thus, if any of these chemicals cannot be used and must be disposed of, they will be disposed of as dangerous waste.

2. **Corrosivity.** 173-303-090(6) describes the characteristics of corrosivity. Corrosive wastes include aqueous wastes with pH less than 2 or greater than 12.5. It may be necessary to use acid to prevent fouling in the NoVOCs system. Any acid waste would be corrosive dangerous wastes. No other corrosive dangerous wastes are expected to be generated exclusively by PPC during this project.

3. **Reactivity**. 173-303-090(7) describes the characteristics of reactive wastes. Reactive dangerous wastes are materials that are unstable, generate toxic gases, or are capable of detonation at standard temperature and pressure. No reactive dangerous wastes are expected to be generated exclusively by PPC during this project.

4. **Toxicity.** 173-303-090(8) describes the characteristic of toxicity. Toxic characteristic wastes are those that leach toxic constituents at concentrations above regulatory levels when tested using the Toxicity Characteristic Leaching Procedure (TCLP). No toxic dangerous wastes are expected to be generated exclusively by PPC during this project.

3.3 Criteria Wastes

If a waste is not a listed or characteristic dangerous waste, it may still be a dangerous waste if it meets certain criteria for toxicity or persistence. These criteria are as follows:

1. **Toxicity.** WAC 173-303-100(5) provides criteria that can be used to determine if a waste is dangerous based on its toxicity. The toxicity criteria include an aquatic toxicity of 100 mg/L or less, an oral toxicity of 5,000 mg/kg or less, an inhalation toxicity of 200 mg/L or less, and a dermal toxicity of 20,000 mg/L or less.

1. **Persistence.** WAC 173-303-100 (6) provides criteria that can be used to determine if a waste is dangerous based on its environmental persistence. The persistence criteria include a halogenated organic content or greater than 0.01% and a polycyclic aromatic hydrocarbon content greater than 1.0%.

4.0 DANGEROUS WASTE MANAGEMENT

If a waste is determined to be a listed or characteristic dangerous waste, the following procedures must be implemented:

1. The dangerous waste must be stored in accordance with WAC 173-303 requirements including appropriate storage containers, labeling, and inspection. All waste will be transferred to an appropriate designated storage area at the facility.

2. The dangerous waste will be delivered to an appropriate Treatment Storage and Disposal Facility (TSDF) for ultimate treatment or disposal. Transport of hazardous waste will be accompanied by a hazardous waste manifest and applicable documentation.

3. As the generator of the dangerous waste (when applicable to PPC), the Site Manager shall compile and keep records demonstrating compliance with applicable requirements

for handling, storing, permitting, record keeping, reporting, and transporting of the dangerous waste.

5.0 SPILL CONTROL AND CONTINGENCY PLAN

Performing any activities at the demonstration site involving or related to the handling of hazardous materials requires an awareness of chemical and emergency response actions that need to be implemented in the event of an accident, injury, spill, or chemical incident. The Health and Safety (H&S) plan developed for this project provides a description of procedures and emergency medical care provisions that will be implemented during the project. This includes general safety precautions, monitoring procedures, emergency contacts, and route to access emergency medical care. In addition, PPC and subcontractor staff are working with hazardous materials will have spill cleanup kits appropriate to the materials being handled.

The field procedures specified in the facility SPCC plan will be followed in the event of an incident or emergency. This includes containment of any emergency where possible (e.g., use of fire extinguishers, containment, etc.) and notification of Boeing emergency response teams. The necessary contacts and phone numbers for such response are included in the project H&S plan.

In the event that a spill or emergency incident occurs, the steps/procedures leading up to the event will be reviewed as a follow-up process. The follow-up process will be used to identify operational/equipment changes necessary to prevent the recurrence of the event. The PPC Site Manager will be responsible for implementation of the necessary operational/equipment changes.

Boeing points-of-contact for waste handling/transport/treatment/disposal.

Soil	Ken Chaput/ Hyland Lee
Water	Ken Chaput/ Larry Peterson

Numerous sources exist to provide information on various aspects of the handling of hazardous waste. The following is a partial list of organizations with telephone numbers that may be used.

Chemical Manufacturers Association (CHEMTREC)
(800)-262-8200 (emergency)
(800)-424-9300 (non-emergency)

RCRA Hotline
(800)-424-3452

Department of Transportation
(202)-366-7378
SARA Hotline
(800)-535-0202

NIOSH Hotline
(800)-356-7674

American Chemical Society
(800)-227-5588